Abstract No. chen676

Characterization of Langanite As-Grown Crystal by Synchrotron White Beam X-ray Topography

H. Chen, M. Dudley (SUNY, Stony Brook) and C. Fazi (Army Research Lab)

Beamline(s): X19C

Introduction: Langanite ($La_3Ga_{5.5}Nb_{0.5}O_{14}$ or LGN) with the $Ga_3Ga_2Ge_4O_{14}$-type structure, like LGT, is also a promising piezoelectric material. It has temperature compensation at near room temperature, high frequency stability, adequate electromechanical coupling factors, low acoustic friction (high Q factor) and high phase transformation temperature. X-ray topography of the surface of as-grown boule enable one to observe the true microstructure developed during the crystal growth process, and is imperative for understanding the nature and distribution of imperfections.

Methods and Materials: LGN single crystal boule was grown by Czochraksi method. The curved surface of the LGN boule was examined by SWBXT with reflection geometry, shown in Figure 1. Topographs were recorded covering the entire length of the boule in longitudinal strips. After imaging of one strip of surface, the boule was rotated by a few degrees in a clockwise direction, the next strip of surface was imaged.

Results: Clear striations contrast, K, perpendicular to the growth axis X can be observed in X-ray topographs, Figure 2. Wavy surface features, A, are caused by the lines on the surface running along the length of the boule, which superimposed onto the striations. White contrasts, C, running across the growth direction in (b) to (c) and (f) to (i) are due to the heavy ridges going around the surface, Figure 3. Numerous white contrasts, P, scattered in the boule are probably due to the presence of precipitates. White contrasts, C in the middle of the boule are due to rough surface blocked the diffracted beam, Figure 4.

Conclusions: Surface X-ray topography of LGN boule was successfully carried out. Defects, such as striations and precipitates can be observed. Topographs are dominated by contrast related to surface features.

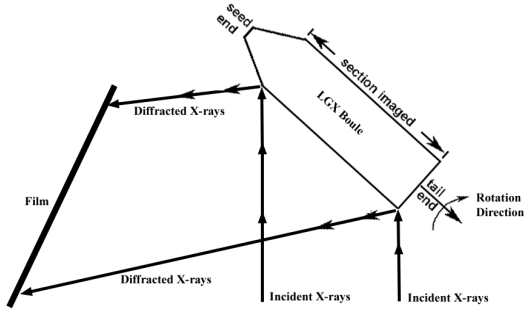

Figure 1. Schematic diagram of reflection geometry

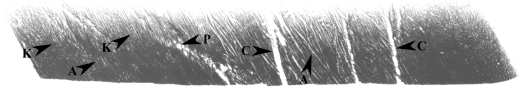

Figure 3. X-ray topograph showing striations, K, precipitates, P, wavy surface feature, A, and surface features, C, due to heavy ridges around surface

Figure 4. X-ray topograph showing well defined striations, K, possible precipitates, P, wavy surface features, A, and rough surface features, C

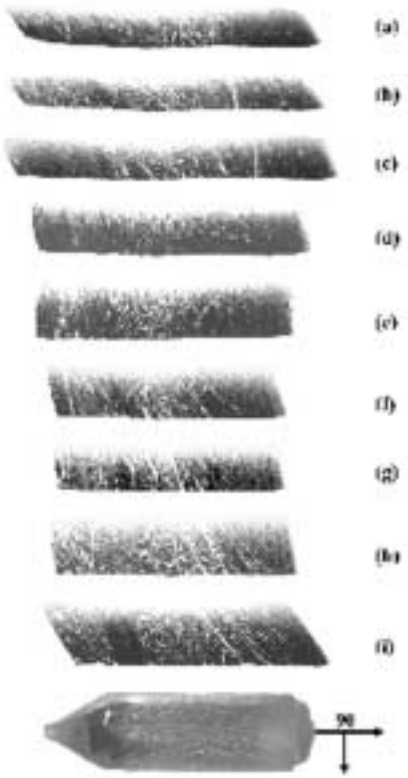

Figure 2. SWBXT images of LGN Boule recorded from reflection geometry.